

ROUGH DRAFT
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INSTRUCTION MANUAL FOR
MODEL 2-M MINIATURE RECEIVER
PROJECT NO. 32235

INTRODUCTION

The Model 2-M is a compact sensitive receiver designed and constructed
by the [] to be used by the []

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[] At present it is considered as
being the best available compromise between volume, sensitivity and battery
life. The tube and battery complement is composed of standard readily-
available inexpensive units. The 2-M is equipped with audio and radio-
frequency gain controls and a beat frequency oscillator switch. Five
directional loops and six tuning units are provided to cover the frequency
range of 500 kilocycles to 15 megacycles. Also included is a belt with
two battery clips and a 200-microampere meter for S-meter readings.

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This receiver has been cleaned thoroughly with carbon-tetrachloride and sprayed with a transparent plastic film to lessen the effects of moisture and corrosion.

If other than minor adjustments or repairs seem necessary on this unit it is recommended that it be returned to the where equipment and spare parts are available more readily.

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A project is in progress to increase the frequency range of this unit. This probably will be in the form of another R.F. unit so that no increase in physical volume will result.

COMPONENT DESCRIPTION

A. Volume

The volume of the 2-M is approximately 41 cubic inches. The weight is two and one-half pounds. These figures include the receiver and its power supply.

B. Sensitivity

The space sensitivity varies from 50 microvolts per meter to 200 microvolts per meter, depending on battery condition and the particular tuning range in use. This means that if the receiver is tuned to a signal of 50 to 200 microvolts per meter field strength at 30% modulation, standard output will be experienced. Standard output in this case is defined as a signal voltage, impressed on the earphone unit, which is two microwatts above the receiver noise level. This is a minimum useful signal. Increased sensitivity may be experienced when the B.F.O. is used.

C. Selectivity

The bandwidth of the 2-M is about 2 kilocycles. Since there is only one tuned circuit ahead of the mixer stage the image rejection ratio necessarily is low. Therefore in tuning the receiver the operator should make certain that he is not tuned to the image signal.

D. Battery Life

The "B" battery current drain at 67-1/2 volts is about 18 MA. Information obtained from dry cell manufacturers and actual receiver operation indicate the sensitivity and voltage will decrease to one-half in from 6 to 8 hours of continuous operation. If operation is other than continuous, greater battery life will result.

The "A" battery current drain at 1-1/2 volts is 250 MA. The "A" battery voltage will decrease by about 20% in the same period of time. Both batteries should then be replaced.

	Battery Type Numbers		
	<u>RCA</u>	<u>Eveready</u>	<u>Burgess</u>
"B"	VS082	457	K45
"A"	VS069	720	2D

E. Tube Complement

The tube line-up consists of a 1R5 mixer, a 1T4 I.F. amplifier (and beat oscillator), a 1S5 second detector and first audio amplifier, and a 3S4 audio output.

F. Gain Controls

The audio gain control is the 3/4" black knob farthest from the tuning unit. The switch in the counterclockwise position of this control disconnects the "A" supply. The R.F. gain control is next to the audio gain control towards the tuning unit. The R.F. gain control operates as a regeneration control in the b.f.o. position and will be described in the next paragraph.

G. Beat Frequency Oscillator

In order to eliminate an extra tube and transformer, b.f.o. action is obtained by introducing feedback into the I.F. stage. This feedback is obtained by operating the toggle switch on the top panel. The R.F. gain control acts as a regeneration control in this position. Besides b.f.o. action, increased sensitivity may be experienced in this position.

H. Tuning Units

There are six tuning units to cover the frequency range of 500 kilocycles to 15 megacycles. The units are slug-tuned with powdered iron cores purchased especially for this application. Each unit is calibrated and labeled as to frequency range. Due to the difficulty of tracking slug-tuned coils built in this compact form an antenna trimmer has been provided so that maximum sensitivity may be obtained at any point in the band. In most cases this extra sensitivity will not be necessary. However if it is required the trimmer is accessible through a hole in the side of the tuning unit.

The tuning units are installed and removed by tightening and loosening the wing nut on the bottom of the receiver. To install a particular unit turn the receiver on and push the tuning unit into position until operation is normal before tightening the wind nut. Care must be taken not to tighten the wind nut too tightly or the sliding yoke mechanism will jam and tuning will be impossible.

I. Directional Loops

There are five loops for the six frequency ranges. The largest loop is used for the two lower frequency bands. Each loop is labeled for its designed frequency range. Since the loop inductance is in series with the mixer coil, misalignment will result if the correct loop is not used. The cable leading to the loop may be placed over the shoulder so that the plane of the loop is parallel and adjacent to the back, thus locating the null fore and aft, or one arm may be inserted through the loop to the shoulder, locating the null to the right and left.

J. Belt

The belt is to be inserted between the tuning unit and the brass strap immediately under the earphone unit on the receiver and back through the spacer adjacent to the 3S4 output tube. If the belt is placed along the concave curvature, placing it between the receiver and the operator, it will cause minimum interference when manipulating the tuning control. To install the "B" battery on the belt with the clip provided, place the double center bar of the clip vertically along the large face of the battery which is farthest removed from the snap terminals so that each

single bar folds over either end of the battery. Starting from the double bar face of the battery, insert the buckle end of the belt between the single bar and the battery on the end which is adjacent to the male snap. Fold the belt over the face opposite the double bar and through the space between the other single bar and battery. The "A" battery is installed in a like manner except that the large pin should be closest to the buckle so that proper pin alignment will result.

K. S-Meter

The S-meter is a 200-microampere meter in series with a 5000-ohm resistor. This in effect measures the voltage drop across the 390-ohm decoupling resistor of the I.F. stage. Since this stage is supplied with AVC voltage from the diode detector a decrease in the S-meter reading may be expected with increased signal. There will be no appreciable AVC voltage until the loop is in a field of about 6 millivolts per meter. A half-wave dipole in free space radiating 1 watt induces a field of about 4 millivolts at one mile. The following table gives approximate S-meter readings to be expected for various field intensities. It must be remembered that these are only very rough approximations. Considerable variation will be experienced from variation in supply voltages, misalignment, tube condition, etc.

S-Meter Reading
Microamperes

Field Intensity
Millivolts per Meter

160	6.4
140	10
150	12
100	24
80	38
50	80
40	250
20	1000

Tests were conducted at the in an attempt to get some idea of the effective range of this receiver. One watt of energy at 10 megacycles was fed into a vertical quarter-wave antenna. The generator and the antenna were located inside a building of reinforced concrete construction. It was found that a useful signal still existed at three-quarters of a mile through a wooded countryside. Similar tests are under consideration to determine its effectiveness under more urban conditions.

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